Claims

[c1]   1. A data-exchangeable universal serial bus (USB) device that accesses another USB device directly to store or retrieve data, which comprises:

an USB interface module comprising:

an USB host core circuit, for communicating with the another USB device operating at a device mode; and

an USB device core circuit, for communicating with the another USB device operating at a host mode; and

a function module, electrically connected to the USB interface module, which further comprises a mass storage device for storing data, and automatically accessing a storage of the another USB device operating at the device mode.

[c2]   2. The data-exchangeable USB device of claim 1, wherein the USB interface module further comprises:

a first switch, electrically connected to a D+ signal line of an USB interface at one terminal, and electrically connected to a high voltage level at another terminal;

a second switch, electrically connected to the D+ signal line of the USB interface at one terminal, and electrically connected to a ground reference at another terminal;

and

a third switch, electrically connected to a D- signal line of the USB interface at one terminal, and electrically connected to the ground reference at another terminal; wherein the first switch is turned off and the second and third switches are turned on when the another USB device operates at the device mode, and the first switch is turned on and the second and third switches are turned off when the another USB device operates at the host mode.

[c3]   3. The data-exchangeable USB device of claim 2, wherein the first switch is a first transistor in which a pull-up resistor is used to connect the first transistor to the high voltage level; the second switch is a second transistor in which a first pull-down resistor is used to connect the second transistor to the ground reference; the third switch is a third transistor in which a second pull-down resistor is used to connect the third transistor to the ground reference; a type of the first transistor is different from a type of the second transistor and the type of the second transistor is same as a type of the third transistor; the first, the second, and the third transistors are controlled by a host-mode signal; when the another USB device is at the device mode, the host-mode signal is enabled; as a consequence, the first transistor is turned

off, the second and the third transistors are turned on; when the another USB device is at the host mode, the host-mode signal is disabled; as a consequence, the first transistor is turned on, the second and the third transistors are turned off.

[c4]   4. The data-exchangeable USB device of claim 1, wherein the function module further comprises:
a buffer device, electrically connected to the mass storage device and the USB interface module, for temporarily storing data; and
a control device, for controlling the mass storage device, the buffer device, and the USB interface module.

[c5]   5. The data-exchangeable USB device of claim 4, wherein the function module further comprises:
a MP3 codec, electrically connected to the buffer device, for converting a MP3 data to an analog voice data stored in the buffer device during a play-mode of the data-exchangeable USB device.

[c6]   6. The data-exchangeable USB device of claim 4, wherein the buffer device further comprises a first buffer, a second buffer, and a third buffer in which the data-exchangeable USB device first reads a file allocation table (FAT) from the another USB device to the first buffer, according to the FAT stored in the first buffer, data stored

in a data block of the another USB device is read and stored to the second buffer, then, while consuming data stored in the second buffer, another data block of the another USB device is read and stored to the third buffer, further, while consuming data stored in the third buffer, another data block of the another USB device is read and stored to the second buffer, by repeating a read–and–consume procedure described above, data stored in the another USB device is consumed continuously on the data–exchangeable USB device, and during a play pause, all related data blocks of the another USB device are read and stored to the mass storage device.

[c7] 7. The data–exchangeable USB device of claim 4, wherein the mass storage device further comprises:
a nonvolatile storage media, for storing data;
a storage interface, electrically connected to the non–volatile storage media, for accessing data stored in the nonvolatile storage media.

[c8] 8. The data–exchangeable USB device of claim 7, wherein the nonvolatile storage media is comprised of a flash memory.

[c9] 9. The data–exchangeable USB device of claim 4, wherein the control device comprises:
a central processing unit (CPU), used as a control center

of the data-exchangeable USB device;

a nonvolatile memory, electrically connected to the CPU, for storing a driver program of the data-exchangeable USB device; and

a volatile memory, electrically connected to the CPU, for temporarily storing CPU data.

[c10] 10. A data-exchangeable USB device that is directly connected to another USB device so that data is exchanged between each other, which comprises:

a function module, controlled by a user, for operating at a device mode or a host mode, and outputting a mode signal; and

an USB interface module, electrically connected to the function module and the another USB device, according to the mode signal, operating at the device mode or at the host mode, and in accordance with an USB standard, allowing instructions and data flowing back and forth between the data-exchangeable USB device and the another USB device, wherein when the USB interface module operates at the host mode, the function module issues an instruction to the another USB device and accesses a storage in the another USB device accordingly, and when the USB interface module operates at the device mode, the function module receives an instruction from the another USB device and executes the instruction

accordingly.

[c11]   11. The data-exchangeable USB device of claim 10,
wherein the USB interface module comprises:
a USB device core circuit, for receiving an instruction and
transfering data accordingly when the function module
operates at the device mode; and
a USB host core circuit, for transmitting the instruction
and transferred data accordingly when the function
module operates at the host mode.

[c12]   12. The data-exchangeable USB device of claim 11,
wherein the USB interface module further comprises a
first switch, a second switch, and a third switch, in which
the first switch is electrically connected to a D+ signal
line of an USB interface and a high voltage level, the sec-
ond switch is electrically connected to the D+ signal line
of the USB interface and a ground reference, and the
third switch electrically connected to a D- signal line of
the USB interface and the ground reference; further, ac-
cording to the mode signal, the USB interface module
operates accordingly that is when the function module
operates at the host mode, the first switch is turned off
and the second and third switches are turned on, and
when the function module operates at the device mode,
the first switch is turned on and the second and third
switches are turned off.

[c13]　13. The data-exchangeable USB device of claim 12, wherein the first switch comprises a first transistor and a pull-up resistor, the second switch comprises a second transistor and a first pull-down transistor, and the third switch comprises a third transistor and a second pull-down transistor.

[c14]　14. The data-exchangeable USB device of claim 10, wherein the function module comprises:
a control device, for controlling circuits of the data-exchangeable USB device;
a buffer device, electrically connected to the control device and the USB interface module, for temporarily storing data; and
a mass storage device, electrically connected to the buffer device, for storing or retrieving data.

[c15]　15. The data-exchangeable USB device of claim 14, wherein the mass storage device comprises:
a nonvolatile storage media, for storing data; and
a storage interface, electrically connected to the nonvolatile storage media, for accessing the nonvolatile storage media.

[c16]　16. The data-exchangeable USB device of claim 15, wherein the nonvolatile storage media is comprised of a

flash memory.

[c17]   17. The data-exchangeable USB device of claim 14,
wherein the function module further comprises a digital-
to-analog (A/D) codec electrically connected to the
buffer device, used to convert digital data to analog data
while the data-exchangeable USB device is at a play-
state.

[c18]   18. The data-exchangeable USB device of claim 17,
wherein the A/D codec is a MP3 codec.

[c19]   19. The data-exchangeable USB device of claim 14,
wherein the control device comprises:
a CPU, used as a control center to the data-ex-
changeable USB device;
a nonvolatile memory, electrically connected to the CPU,
for storing a driver program of the data-exchangeable
USB device; and
a volatile memory, electrically connected to the CPU, for
temporarily storing CPU data.

[c20]   20. The data-exchangeable USB device of claim 14,
wherein the buffer device further comprises a first
buffer, a second buffer, and a third buffer in which the
data-exchangeable USB device first reads a file allocation
table (FAT) from the another USB device to the first

buffer, according to the FAT stored in the first buffer, data stored in a data block of the another USB device is read and stored to the second buffer, then, while consuming data stored in the second buffer, another data block of the another USB device is read and stored to the third buffer, further, while consuming data stored in the third buffer, another data block of the another USB device is read and stored to the second buffer, by repeating a read-and-consume procedure described above, data stored in the another USB device is consumed continuously on the data-exchangeable USB device, and during a play pause, all related data blocks of the another USB device are read and stored to the mass storage device.